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Late Pleistocene Avifauna of the Razhishkata Cave, Western Bulgaria

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Introduction

Last few years a series of publications on the Late Pleistocene fauna of birds in Bulgaria has appeared. With an exception of the more exhaustive data on the Pleistocene birds of the Bacho Kiro Cave (Bochenski, 1982), the papers on the Pleistocene avifauna of Bulgaria deal with avian remains from caves, mainly from the NW parts of the country (Boev, 1995; 1998; 1999a; 1999b; 2000).

Description of the site

Location: Near to the Lakatnik railway station, Sofia District, UTM grid: KH 68; about 500 a. s. l. (Fig. 1).

Associated fauna: *Cuon alpinus*, *Capra ibex*, *Crocidura leucodon*, *Chionomys nivalis*, *Microtus subterraneus* (V. Popov, pers. comm.).

Dating: The final of the Late Pleistocene, probably including the transition to Holocene (V. Popov, pers. comm.).

Taphonomy: The avian remains were accumulated by the large nocturnal raptors, most probably, the Eagle Owl (*Bubo bubo*).

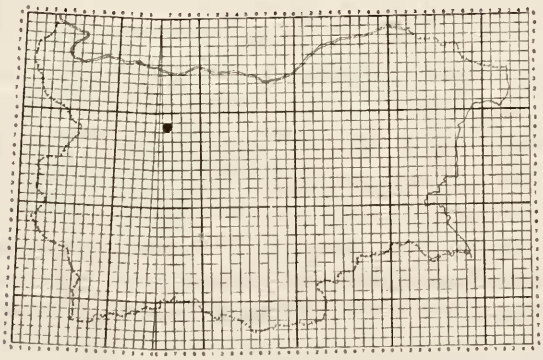

Fig. 1. Location of the Razhishkata Cave

Material and methods

A total of 185 whole bones and bone fragments of birds were collected: No 6471-6499; 7577-7603; 7930-7958; 8512-8526; 8918-8923; 9670-9694; 11275-11327; 11442. All finds are kept in the Fossil and Recent Birds Department of the National Museum of Natural History, Bulgarian Academy of Sciences, Sofia. The whole vertebrate's bone material was collected through the washing and sieving of the excavated sediments by Dr. Vassil Popov (Institute of Zoology, BAS), who handed the avian remains for examination.

The anatomical and stratigraphical belonging of the skeletal elements of each find is shown on Table 1. The osteological terminology follows BAUMEL & WITMER (1993). The reference measurements, given in mm, are provided only for the species established for the first time in the fossil record in Bulgaria (Table 2).

Species composition

The avifauna in the surroundings of the cave was rich and varied. At least 27 species (39 taxa) of 7 orders of birds are established by their bone remains (Table 1). They are referred both, to resident and migratory (breeding and winter visitors) species according to their present-day residental status of their populations on the Balkans.

Palaeoecological analysis

The established species composition shows the distribution of 4 ecological types of birds according to their nesting-habitat preferences (after Harrison, 1975): wood, field, water and rock. The species that indicate the former distribution of mixed, chiefly broad-leaved, forests are the most numerous. This group consists of 11 taxa: *Tetrao tetrix*, *Bonasa bonasia*, *Asio otus*, *Anthus* cf. *trivialis*, *Parus major*, *Sylvia* sp., *Fringilla montifringilla*, *Loxia curvirostra*, *Coccothraustes coccothraustes*, *Carduelis chloris* and cf. *Garrulus glandarius*. The species that needs of openland landscape to nest and feed are placed second. Their group consists of 6 taxa: *Perdix palaeoperdix*, *Perix perdix*, *Coturnix coturnix*, *Melanocorypha* sp., Carduelinae gen., and *Corvus corone/frugilegus*. The hydrophilous species indicating the presence of a large fresh-water slow running or steady bodies are referred to 4 taxa: *Anser* sp., *Anas* sp., *Crex crex* and *Tringa* cf. *stagnatilis*. The composition of the petrophylous bird species includes 7 taxa: *Athene noctua*, *Apus melba*, *Ptyonoprogne rupestris*, *Corvus monedula*, *Pyrrhocorax graculus*, *Pyrrhocorax pyrrhocorax* and *Petronia petronia*.

Table 1

Taxonomic list, collection numbers, sounding, depth (cm) and MNI (minimum number of individuals) of the Late Pleistocene birds of the Razhishkata Cave

Taxa	Collection numbers (NMNHS), sounding, depth and skeletal elements	Number of finds	MNI
ANSERIFORMES			
Anser sp.	phalanx dist. dig. pedis - 9688 (s. 2)	1	1
Anas sp.	scapula sin. dist. - 6492 (s. 2/100-120)	1	1
GALLIFORMES			
Tetrao tetrix	humerus sin. prox. - 6493 (s. 2/155); cranium - rostrum - 7582 (s. - /290-298)	2	1
Tetrao cf. *tetrix*	phalanx. dist. dig. pedis. - 6495 (s. 2/155-165)	1	1
Bonasa bonasia	coracoid dex. prox. - 7591 (s. - /420); vert. cerv. III - 7592 (s. -/ 420); phalanx 1dig. I pedis sin.- 7593 (s. - / 420)	4	1
Bonasa cf. *bonasia*	os quadratum sin.- 7594 (s. -/ 420)		
Perdix palaeoperdix	vert. cerv. 2 - 7944 (-); humerus sin. dist. - 8523 (s. - / 250-258); tibiotarsus sin. dist. - 9689 (s. 1/250-258)	3	1
Perdix cf. *palaeoperdix*	coracoid sin. dist. - 6489 (-); os quadratum - 7939 (s. 2/ 20-300); phalanx dig. pedis - 7940-7942 (s. 2/ -); 7943 (s. 1/420); scapula dex. prox. - 8525 (s. -/200-230); ulna sin. dist. - 9690 (s. 1/250-258)	10	2
Perix perdix	phalanx dist. dig. pedis - 6479 (s. 2/250-280); 6499 (s. 2/250-280); phalanx dig. pedis - 6496-6498 (s. 2/155-165); 7947 (s. 2/ -); furcula - 7599 (s. 2/225-245)	6	1
Perix cf. *perdix*	os quadratum - 6474 (s. 2/ -); phalanx dig. 2 pedis 3 - 6475 (s. 2/ -); phalanx dig. 2 pedis 3 - 6476 (s. 2/ -); phalanx dist. dig. pedis - 6478 (s. 2/250-280); 6485 (s. 1/380)	5	1
Perdix perdix/palaeoperdix	cmc dex. prox. - 7589 (-/290-315); os coxae dex. - 7945 (s. 2/280-300); phalanx dig. pedis - 7958 (s. 2/ -); mandibula - apex - 8920 (s. 2/ -)	3	1
Coturnix coturnix	scapula sin. - 8522 (s. -/250-258)	1	1
GRUIFORMES			
Crex crex	humerus sin. dist. - 8512 (s. -/250-258)	1	1
CHARADRIIFORMES			
Tringa cf. *stagnatilis*	trochlea 4 metatarsi si. dist. - 9686 (s. 2/100-120)	1	1
STRIGIFORMES			
Athene noctua	phalanx dig. pedis - 8521 (s. -/30-100); sternum, pars coracoidalis - 11277 (s. 1/245)	2	1
Asio otus	tibiotarsus sin. dist. - 7588 (s. -/290-298)	1	1
APODIFORMES			
Apus melba	humerus sin. prox. - 7957 (-); phalanx dist. dig. pedis - 8918 (s. -/100-120)	2	1

Table 1 (continuation)

Taxa	Collection numbers (NMNHS), sounding, depth and skeletal elements	Number of finds	MNI
PASSERIFORMES			
Melanocorypha sp.	cranium - pars maxillaris - 11278 (s. 2/280-300); 11281 (s. 2/220)	2	2
Anthus cf. *trivialis*	humerus dex. prox. - 9682 (s. 2/100-120); 9683 (s. 2/-)	2	2
Anthus sp.	tarsometatarsus.sin. dist. - 9684 (s. 2/100-120)	1	1
Parus major	tibiotarsus sin. dist. - 9687 (s. 2/-)	1	1
Sylvia sp.	cmc dex. - 9691 (s. 2/250-280)	1	1
Ptyonoprogne rupestris	humerus dex. prox. - 8921 (s. 2/100-120)	1	1
Fringilla montifringilla	humerus dex. prox. - 8922 (s. 2/ -)	1	1
Loxia curvirostra	humerus sin. dist. - 8519 (s. -/280-300)	1	2
Coccothraustes coccothraustes	carpometacarpus dex. prox. - 8919 (s. 2/-)	1	1
Carduelis chloris	cranium - pars maxillaris - 11275 (s. 1/250-258)	1	1
Carduelinae gen.	mandibula dex. - 11316 (s. 2/-)	1	1
cf. *Garrulus glandarius*	vert. cerv. - 6482 (s. 2/-); phalanx 1 dig. 1 pedis sin. - 7956 (s. 1/290-315)	2	1
Corvus monedula	os coxae sin. - 6477 (s. 2/250-280); coracois sin. dist. - 7595 (s. -/200-230); phalanx 1 dig. 1 sin. - 7596 (s. -/200-230); phalanx dist. dig. 1 pedis - 7597 (s. -/200-230); scapula sin. - 9673; scapula dex. prox. - 9674 (s. 1/250-258); carpometacarpus dex. - 9675 (s. 1/290-315); ulna dex, prox. - 9676 (s. 1/290-315)	6	2
Corvus corone/frugilegus	tibiotarsus. dex. dist. juv. - 6483 (s. 1/420); phalanx dist. dig. pedis - 7955 (s. 1/290-315)	2	1
Corvus sp.	phalanx dist. dig. pedis - 7603 (s. 2/-)	2	1
Pyrrhocorax graculus	coracoid dex. dist. - 6472 (s. 2/-); tarsometatarsus sin. dist. - 6491 (s. 2/220); cmc sin. - 7583 (s. -/290-298); 9671 (s. 1/223-258); 9677 (s. 1/290-315); humerus dex. prox. - 7584 (s. -/290-298); humerus dex. dist. - 9670 (s. 1/223-258); cmc sin. prox. - 7934 (s. 1/92-120); phalanx 1 dig. 1 pedis dex. - 7946 (s. 1/460-480); sternum - 9672 (s. 1/223-258); tibiotarsus sin. dist. - 9678 (s. 1/250-258); tibiotarsus sin. dist. - 9680 (s. 1/250-258); femur sin. prox. - 9685 (s. 1/160-190)	14	3
Pyrrhocorax cf. *graculus*	tabula sterni sin. - 9679 (s. 1/250-258)	1	1
Pyrrhocorax pyrrhocorax	femur dex. dist. - 9681 (s. 1/223-258)	1	1
cf. *Pyrrhocorax* sp.	phalanx dig. pedis 1 - 8520 (s. -/430)	1	1
Corvidae gen.	phalanx dist. dig. pedis - 6480 (s. 2/100-120); 7930 (s. 1/-); 7931 (s./-); phalanx dist. pedis - 6484 (s. 2/-); 6487 9 (s. 2/220); 7598 (s. 2/225-245);	6	1

Table 1 (continuation)

Taxa	Collection numbers (NMNHS), sounding, depth and skeletal elements	Number of finds	MNI*
	coracoid sin. prox. - 7581 (s. -/120-150); phalanx dig. pedis - 7935 (s. 1/60-90); femur dex. prox. - 11293 (s. 2/280-300)		
Petronia petronia	mandibula - apex - 11276 (s. 1/250-258)	1	1
Passeres fam.	rostrum maxillarae - 11317 (s. 2/-); vert. cerv. - 6481 (s. 2/155-165); 6486 (s. 2/-); 6488 (s. 2/200); 6490 (s. 2/250-290); 6494 (s. 2/155-165); 7586 (-); 7948-7950 (s. 2/250-280); phalanx dig. pedis - 7587 (-); phalanx dist. dig. pedis - 9693 (s. 2/100-120); synsacrum sin. - 9692 (s. 1/380); phalanx prox. dig. maj. sin. - 11304 (s. 2/100-120); synsacrum - corpora vertebrorum - 11282 (s. 2/-); 11322 (s. 2/280-300); humerus sin. dist. - 11306 (s. 2/100-120); humerus dex. dist. - 11309 (s. 2/100-120); 11318 (s. 2/-); humerus dex. prox. - 11307-11308 (s. 2/100-120); 11314 (s. 2/-); humerus sin. prox. - 11279 (s. 1/200-230); 11283 (s. 2/-); 11315 (s. 2/-); humerus sin. - 11288 (s. 1/250-258); 11313 (s. 2/-); 11321 (s. 2/280-300); coracoid dex. dist. - 11323 (s. 2/280-300); coracoid dex. prox. - 11327 (s. 2/-); radius dex. - 11298 (s. 2/-); cmc dex. - 11292 (s. 2/280-300); cmc dex. prox. - 11294 (s. 2/-); cmc sin. prox. - 11296 (s. 2/-); ulna sin. dist. - 11299 (s. 2/-); ulna sin. prox. - 11300 (s./-); 11325 (s. 2/280-300); ulna dex. - 11286 (s. 1/250-258); tibiotarsus dex. dist. - 11305 (s. 2/100-120); 11310 (s. 2/100-120); tibiotarsus sin. dist. - 11287 (s. 1/250-258); tarsometatarsus dex. dist. - 11297 (s. 2/-); 11302-11303 (s. 2/100-120); 11320 (s. 2/280-300)	42	6
Aves indet. (sounding and depth not cited)	vert. cerv. - 6473; 6471; 7590; 7601; 7933; 7937; 7938; 8513; ulnare - 8514; tibiotarsus - 7577; 7579; 7580; 7600; 8526; vert. cerv. 2 - 7951; costa prox. - 7578; femur dex. prox. - 11324; femur dex. dist. - 7585; 11295; humerus sin. - 7602; humerus - 7952; humerus dex. prox. - 7953; phalanx dist. dig. pedis - 7932; phalanx dig. pedis - 7936; 7954; 8515-8518; 11284; os quadratum - 8923; 9694; synsacrum corp. vert. - 11280; synsacrum - pars acetab. dex. - 11290-11291; 11319; synsacrum - pars sin. - 11442; tibiotarsus dex. prox. - 11326; tibiotarsus sin. prox. - 11285; apex mandibularae - 11289; mandibula dex. prox. - 11311; sternum - 11301; radius dex. prox. - 11312	41	4
Total		**185**	**55**

Woodland species

***Tetrao tetrix* Linnaeus, 1758.** A resident dendrophylous species of the Boreal and Temperate zones. Prefers the endings of coniferous, light mixed woods and grassy habitats near the bogs and forest. It is spread in the Palearctic between 11° and 21°-24° Ñ July isotherms. In the northern parts of its range chiefly inhabits the plains, while in the southern parts in occurs in the mountains up to 2000 m a. s. l. (HARRISON, 1982). As a glacial relict it is still survived in the Alps at 2500 m a. s. l. In the 19th century the Black Grouse totally reduced its range and the population number throughout Europe. A sedentary species, sometimes makes short migrations up to 17-20 km (CRAMP & SIMMONS, 1980). *T. tetrix* is an autochnous species for the forest-steppe landscape of Eastern Europe. In the last millennium the species secondarily inhabits the forest habitats because of the deforestation and habitat devastation (VOINSTVENSKIY, 1960; GOLOVANOVA, 1975; NAZARENKO, 1957). Dense bushes and steppes were among the preferred habitats of the species in the SE Europe (KIRIKOV, 1959). COUTURIER & COUTURIER (1980) summarise that during the Pliocene (perhaps these authors have in mind the Pleistocene - Z. B.) the Black Grouse was widely spread in Europe. BRODKORB (1964) lists more than 80 Quaternary sites, 9 of them of Pleistocene. Most of these sites are located in the present range of *T. tetrix*. Some of the Holocene sites (Neolithic and Bronze Age) are far beyond the present range (Malta, Spain, Monaco). TYRBERG (1997) lists a total of 255 Pleistocene sites: 3 of Early Pleistocene; 23 of Middle Pleistocene and 229 of Late Pleistocene. COUTURIER & COUTURIER (1980) state that the considerable reduction of the species' range in Europe begins during the Holocene. Following the more recent data (SCHMITZ, 1997), several nesting sites still survived in the NW of Macedonia and Montenegro. Data about its recent southernmost distribution in E Europe (VOOUS, 1960; MAKATSCH, 1974; CRAMP & SIMMONS, 1980; SCHMITZ, 1997) support the assumption about its former distribution through Bulgaria. The Razhishkata Cave provides the 3rd Pleistocene record of *T. tetrix* from Bulgaria. The Black Grouse was established also in the Late Pleistocene deposits of the Mirizlivka Cave (BOEV, 1997) and the Cave No 16 (BOEV, 1999a).

***Bonasa bonasia* (Linnaeus, 1758).** A resident species of the Boreal and the Temperate zones. Inhabits dense, mainly coniferous, forests with undergrowth in the mountains. The species range is limited by the 13° and 21°-22° C July isotherms. Deforestation reduced its range during the last millennia (HARRISON, 1982). Prefers old mature woods of *Picea*, *Abies*, *Pinus*, *Larix*, as well as *Alnus*, *Corylus*, *Populus* and *Betula*. It is the most arboreal tetraonid and the presence of bushes' fruits in the summer-autumn season is of considerable importance for its distribution (CRAMP & SIMMONS, 1980). The finds from the Razhishkata Cave are the first fossil record of that species, marking its distribution in the Late Pleistocene of Bulgaria. The site lies outside of the recent breeding range.

***Asio otus* (Linnaeus, 1758).** A resident species of the Boreal and the Temperate zones. Inhabits coniferous, dense and broadleaf forests, but the 15°C July isotherm limits the breeding range northwards. It migrate irregularly in flocks (HARRISON, 1982) chiefly in the winter. Most often spread between 300 and 530 m a. s. l. (CRAMP, 1990). The present range completely coincides with the distribution of the woods of the Northern hemisphere. A typical element of the woodland avifauna in Eurasia and North America since the Pliocene (VOINSTVENSKIY, 1960). The Long-eared Owl was known until now from the Late Pleistocene of the Temnata Doupka Cave (BOEV, 1994) and the Cave No 16 (BOEV, 1999a).

***Anthus trivialis* (Linnaeus, 1758).** A migratory species of the Boreal and the Temperate zones that winters in the Subtropical and Tropical zones. Occurs in the fields with scattered trees, light forests, wood edges of coniferous and broadleaf woods up to the tree-limits in the mountains (HARRISON, 1982). Summer distribution is limited by the 10°-26° C July isotherms. A terrestrial species by its feeding and nesting (CRAMP, 1989). VOINSTVENSKIY (1960) determines its origin from the open landscapes, besides its present day occurrence in the woodland habitats. It is a new (Holocene) element for the European forest-steppe avifauna (VOINSTVENSKIY, 1960). The finds from the Razhishkata Cave provide the second fossil record of that species in Bulgaria. The Tree Pipit was reported first from the Cave No 16 (BOEV, 1999a).

***Parus major* (Linnaeus, 1758).** A resident and partly migratory species from the Subarctic to the Temperate zone. Prefers old forests but also inhabits bush formations. Up to the tree-limit in the high mountains (HARRISON, 1982). Everywhere the distribution during the breeding season is limited by the 12° C and 32° C July isotherms. Terrestrial feeding on the ground in the woods has an important significance. Highly dependent from the tree-hollows for nesting (CRAMP & PERRINS, 1993). The finds (Fig. 2) from the Razhishkata Cave provide the first fossil record of that species in Bulgaria.

***Fringilla montifringilla* (Linnaeus, 1758).** A migratory species from the Subarctic and the Boreal zones. Occurs in the open conifer and birch forests and birch and willow shrub tundra along the rivers (HARRISON, 1982). The breeding range of the Brambling is confined by the 10° C and 18°-19° C July isotherms. More seldom the species inhabits the high forests. Because of its terrestrial feeding during the non-breeding season, it can survive in the regions, where the snow blanket is up to 15 cm thick. Winters in the Temperate zone (CRAMP & PERRINS, 1994). The finds from the Razhishkata Cave provide the first fossil record of that species in Bulgaria.

***Loxia curvirostra* (Linnaeus, 1758).** A resident and wandering species of the coniferous forests of the Boreal and Temperate zones. Prefers old woods. (HARRISON, 1982). Inhabits both, the inner parts of the large woods and the wood endings, most often of *Picea*, *Pinus* and *Larix*. Depends on the nearness of water sources. The food deficiency (mainly seeds of coniferous) causes irregular wander-

Table 2

Measurements of some of the Late Pleistocene avian finds from the Razhishkata Cave

Species	Bone	Collection number	Measurement	Dimension
Bonasa bonasia	coracoid	7591	length of facies articularis sternalis	8,8
Bonasa bonasia	coracoid	7591	width of facies articularis sternalis	2,6
Bonasa bonasia	vert. cerv. III	7592	maximum length	8,0
Bonasa bonasia	vert. cerv. III	7592	heigth in cranial end	4,8
Bonasa bonasia	phalanx 1dig. I pedis sin.	7593	total length	8,4
Bonasa bonasia	os quadratum sin.	7594	maximum length	8,0
Bonasa bonasia	phalanx 1 dig. pedis sin.	7593	heigth of facies articularis proximalis	2,6
Perdix palaeoperdix	tibiotarsus sin. dist.	9689	maximum cranio-caudal diameter of distal epiphysis	6,3
Perdix palaeoperdix	tibiotarsus sin. dist.	9689	minimum cranio-caudal diameter of distal epiphysis	4,5
Perdix palaeoperdix	tibiotarsus sin. dist.	9689	length of pons supratendineus	2,4
Perdix palaeoperdix	tibiotarsus sin. dist.	9689	width of diaphysis in the middle of pons supratendineus	4,7
Tringa stagnatilis	trochlea 4 metatarsi sin. dist.	9686	width of trochlea metatarsi 4	1,6
Athene noctua	sternum, pars coracoidalis	11277	width between the processi craniolaterali	ca. 15,4
Melanocorypha sp.	cranium - pars maxillaris	11278	length of os premaxillare (ventral side)	ca. 5,3
Melanocorypha sp.	cranium - pars maxillaris	11278	maximum heigth os premaxillare	2,4
Melanocorypha sp.	cranium - pars maxillaris	11281	length of os premaxillare (ventral side)	ca. 6,0
Melanocorypha sp.	cranium - pars maxillaris	11281	maximum heigth of os premaxillare	2,6
Parus major	tibiotarsus sin. dist.	9687	maximum cranio-caudal diameter of distal epiphysis	2,4
Parus major	tibiotarsus sin. dist.	9687	maximum cranio-caudal diameter of distal epiphisis	2,4
Parus major	tibiotarsus sin. dist.	9687	minimum width of diaphysis	1,2
Fringilla montifringilla	humerus dex. prox.	8922	width of proximal epiphysis	6,3
Fringilla montifringilla	humerus dex. prox.	8922	width of proximal epiphysis	6,3

Table 2 (continuation)

Species	Bone	Collection number	Measurement	Dimension
Fringilla montifringilla	humerus dex. prox.	8922	width between tuberculum ventrale and tuberculum dorsale	5,9
Coccothraustes coccothraustes	carpometacarpus dex. prox.	8919	width of trochlea carpalis	2,0
Coccothraustes coccothraustes	carpometacarpus dex. prox.	8919	length of synostosis metacarpalis proximalis	7,8
Coccothraustes coccothraustes	carpometacarpus dex. prox.	8919	tickness of os metacarpale majus in the middle	1,6
Carduelis chloris	cranium - pars maxillaris	11275	length of os premaxillare (ventral side)	8,4
Carduelis chloris	cranium - pars maxillaris	11275	maximum width of os premaxillare	8,0
Petronia petronia	mandibula	11276	length of pars symphysialis	5,8
Petronia petronia	mandibula	11276	tickness in the caudal end of pars symphysialis	2,4
Athene noctua	sternum, pars coracoidalis	11277	width between the processi craniolaterali	ca. 15,4

ings to the South (CRAMP & PERRINS, 1994). TYRBERG (1991) summarises that during the Wurmian glacial the main population of *L. curvirostra* was concentrated in the Western Europe. The crossbills evolved in the limited spruce refuges on the Balkans, that survived by the Holocene. After the last glacial, they restored their former range in the pine forests in the NW of the continent. The finds are the 3rd Pleistocene record of the Crossbill in Bulgaria. The species was known until now from the Bacho Kiro Cave (BOCHENSKI, 1982) and the Cave No 16 (BOEV, 1999a).

***Coccothraustes coccothraustes* (Linnaeus, 1758).** A resident and migratory species of the Boreal and the Temperate zones that inhabits the broadleaf and mixed woods. Prefers wood habitats near the rivers and lakes, forest-steppes both, in the plains and the mountains. The food deficiency in winter causes migrations (HARRISON, 1982). The range in summer is limited by the 17° C and 25° C July isotherms. The most specialised species to *Quercus-Carpinus* woods. Also inhabits woods of *Fagus*, *Ulmus*, *Fraxinus* and *Acer* as well as the mixed woods up to the tree-limit in the mountains (CRAMP & PERRINS, 1994). An ancient species of Neogene age, highly adapted to the nut and stone fruit trees, as well as trees of large seeds. The species survived in the Pleistocene only in the suitable refugia in the S-European peninsulas (MOREAU, 1954). The finds (Fig. 2) are the first Pleistocene record of Hawfinch for Bulgaria.

***Carduelis chloris* (Linnaeus, 1758).** A resident species of the Boreal and the Temperate zones. Migratory in the Northern parts of the range. A dendrophylous species (HARRISON, 1982). A granivorous species. During the non-

breeding season inhabits various kinds of habitats. The breeding range is limited by the 14° C July isotherm (CRAMP & PERRINS, 1994). An ancient species in the broadleaf forest landscape (VOINSTVENSKIY, 1960). The finds (Fig. 2) are the first Pleistocene record of the Greenfinch for Bulgaria.

***Garrulus glandarius* (Linnaeus, 1758).** A resident species of the Boreal to the Southern parts of the Temperate zones. A typical wood bird, chiefly inhabiting the broadleaf forests. Rarely in the mixed and the coniferous forests up to the tree-limits (HARRISON, 1982). The breeding range is limited in the summer by the 14° C July isotherm. Mainly a species of the lowland. Arboreal and strongly connected to the forests of *Quercus*, *Fagus* and *Carpinus* (CRAMP & PERRINS, 1994). The species' range is in a regression during the Holocene because of the deforestation (VOINSTVENSKIY, 1960). Until now the Jay was established only from the Late Pleistocene of the Cave No 16 (BOEV, 1999a).

Openland species

***Perdix perdix* (Linnaeus, 1758).** A resident species chiefly from the Temperate zone. Inhabits wet grassy habitats (meadows, pastures, steppes, openland with scattered shrub (HARRISON, 1982). A strictly terrestrial bird of large grassy landscapes. Avoids arid, rocky and wood habitats (CRAMP & SIMMONS, 1980). During the whole Quaternary the species inhabited the steppe zone of Eurasia where penetrated in the woodland from. An autochthonous species since the Pliocene (i.e. the Pleistocene - Z. B.) (VOINSTVENSKIY, 1960). The Late Pleistocene remains of the Grey Partridge are known from the Bacho Kiro Cave (BOCHENSKI, 1982), the Temnata Doupka Cave (BOEV, 1994) and the Cave No 16 (BOEV, 1999a).

***Perdix palaeoperdix* Mourer-Chauviré, 1975.** This species was described by numerous findings from the end of the Middle Pleistocene (Riss) from S France. Diagnosis: "A primitive form of genus *Perdix*, differing from the recent species *Perdix perdix* (L.) by the noticeable smaller dimensions (MOURER-CHAUVIRE', 1975; p. 107). According to VILETTE (1983) *P. palaeoperdix* was a characteristic species for the Middle Pleistocene deposits of Europe. It is considered the direct ancestor to *P. perdix* and its dimensions were smaller than these of all recent subspecies of *P. perdix*. The finds (Fig. 2) from the Razhishkata Cave also have smaller dimensions, compared with the provided metrical data by VILLALTA (1963). They are the second record of this fossil species on the Balkans. The species was known until now only from France, Greece, Spain, SW Russia (N Caucasus) and China (TYRBERG, 1998). The morphological descriptions of Bulgarian finds of that species are subject of a separate paper.

***Coturnix coturnix* (Linnaeus, 1758).** A resident and migratory species from the southern parts of the Temperate zone and the Subtropical zone. The northern limit of its range is limited by the 15° C July isotherm. Inhabits grassy areas in the plains of dry soils, meadows and semideserts (HARRISON, 1982). Avoids arid habitats and wetland. Prefers open hilly treeless terrains up to 1000 m. a. s. l. (CRAMP & SIM-

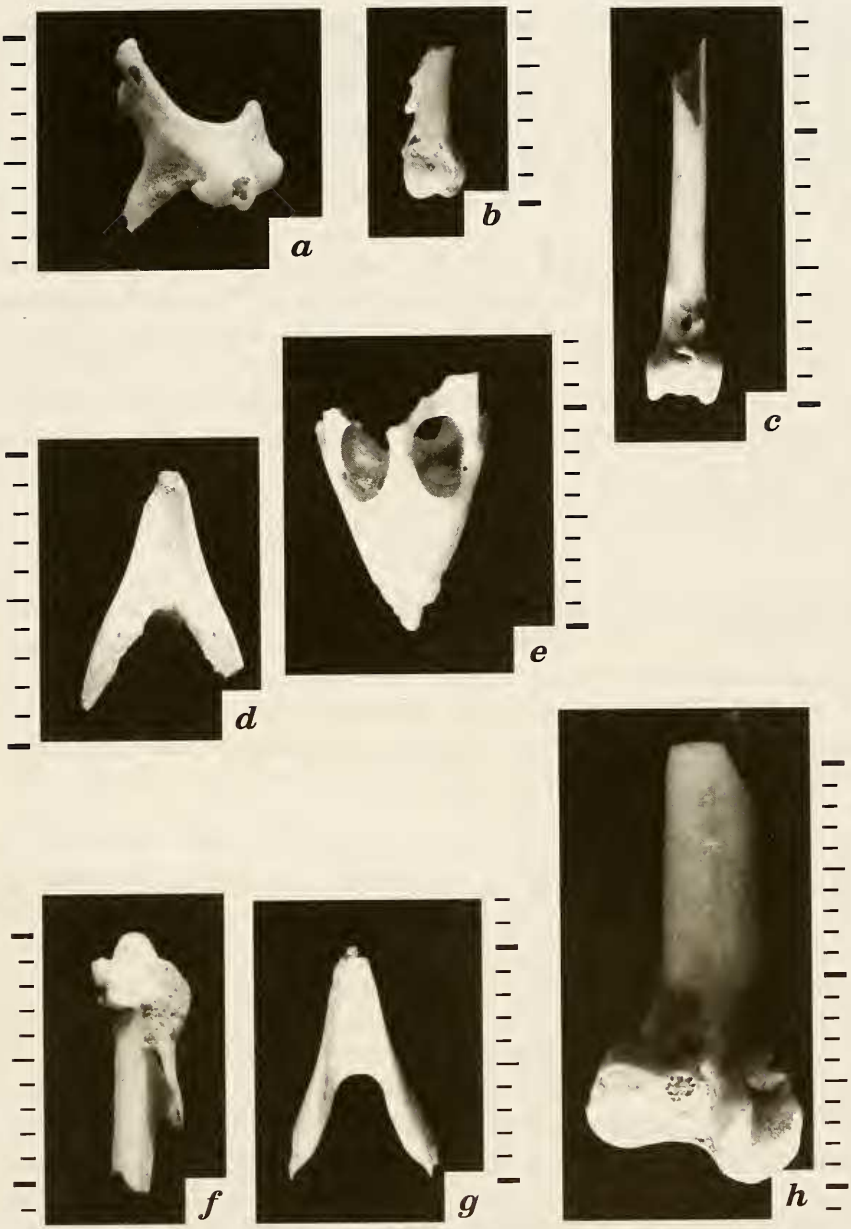

Fig. 2. Some of the Late Pleistocene avian finds from the Razhishkata Cave: a - *Perdix* cf. *palaeoperdix* (os quadratum, NMNHS 7939); b - *Tringa* cf. *stagnatilis* (tarsometatarsus sin dist. - trochlea metatarsi IV, NMNHS 9686); c - *Parus major* (tibiotarsus sin. dist., NMNHS 9687); d - *Melanocorypha* sp. (cranium - pars maxillaris, NMNHS 11278); e - *Carduelis chloris* (cranium - pars maxillaris, NMNHS 11275); f - *Coccothraustes coccothraustes* (carpometacarpus dex. prox., NMNHS 8919); g - *Petronia petronia* (mandibula, NMNHS 11276); h - *Pyrrhocorax pyrrhocorax* (femur dex. dist., NMNHS 9681) (Photographs: Boris Andreev)

MONS, 1980). Data of SIMEONOV & BOEV (1988) show that in Bulgaria the species at present occurs up to 950 m a. s. l. The wide range of the Quail is due the its expansion in the Quaternary (VOINSTVENSKIY, 1960). The finds are the third Pleistocene record of *C. coturnix* in Bulgaria. The species was known until now from the Bacho Kiro Cave (BOCHENSKI, 1982) and the Temnata Doupka Cave (BOEV, 1994).

***Melanocorypha* sp.** The two cranial fragments (Table 1) are homologous and fully correspond to the detaily described praemaxillar fragments of *Melanocorypha* sp. by JANOSSY (1992). We have not any comparative material of the recent species of *Melanocorypha*, spread in Europe, but the comparison with the remaining genera of larks, as well as the illustrations of JANOSSY (1992, p. 15 - fig. 2) for the Early Pleistocene avifauna of Beremend, Loc. 17 in S Hungary and these ones of CASSOLI (1980, tav. 7 - 30) for the Late Pleistocene avifauna of Delle Arene Candide in N Italy allow a reliable comparison of our finds. Both authors mention that the question on the Pleistocene remains of *Melanocorypha* in Europe is still obscure, besides their presence in the cave deposits from the Late Pleistocene. The site lies within the present breeding range of *Melanocorypha calandra* (Linnaeus, 1766). The Calandra Lark is a resident and migratory species from the southern steppe regions of the Temperate zone. A typical steppe species, preferring the communities of *Artemisia*. Avoids the stony habitats (HARRISON, 1982). Less depending on water sources. Tolerates hot summer temperatures up to 32° C (CRAMP, 1988). A species of the virgin steppes in the E Europe (VOINSTVENSKIY, 1960). The finds (Fig. 2) from the Razhishkata Cave provide the first fossil record of that genus in Bulgaria.

Aquatic habitats species

***Crex crex* (Linnaeus, 1758).** A migratory species, breeding from the Boreal to the Temperate zone. Occurs in the grassy habitats, along the bogs, swamps and wet meadows (HARRISON, 1982). Mainly in the lowland. Prefers cool wet tall-grassy habitats and avoids lakes, river banks, sandy and rocky habitats (CRAMP & SIMMONS, 1980). At present a rare nesting, migratory and passage species in Bulgaria. The Pleistocene record of the Corncrake was established in the Bacho Kiro Cave (BOCHENSKI, 1982) and the Temnata Doupka Cave (BOEV, 1994).

***Tringa stagnatilis* (Bechstein, 1803).** A migratory species of the dry steppe of the Temperate zone. Nests in the wet grassy habitats near to bogs and freshwater swamps and lakes (HARRISON, 1982). Avoids salt and alkaline habitats. A rare incidental winter visitor on the Balkans (CRAMP & SIMMONS, 1983). The finds (Fig. 2) from the Razhishkata Cave provide the first Pleistocene record of that species in Bulgaria.

Rock habitats species

***Athene noctua* (Scopoli, 1769).** A resident species from the Boreal to the Temperate zone. Inhabits different habitats including rocky terrains in the

mountains, steppes and light forests (HARRISON, 1982). The most terrestrial species of the Palearctic owls. Avoids the dense wood and shrub vegetation as well as the wetland. Spread up to 2000 m a. s. l. in the Western Palearctic (CRAMP, 1989). The big number of its subspecies (15 according to HOWARD & MOORE, 1980) indicate its long evolution in the Neogene deserts of S Europe and Asia (VOINSTVENSKIY, 1960). The finds represent the first Pleistocene record of the Little Owl from Bulgaria.

***Apus melba* (Linnaeus, 1758).** A migratory species of the southern parts of the Temperate zone. Nests on the rocks of the arid mountain rocky terrains and the rocky shores (HARRISON, 1982). The 21,1° C isotherm limits the species distribution (EASTHAM, 1988). Highly aerial bird that may drift away up to 600-1000 km a day from the nesting colony. Avoids wood habitats (CRAMP, 1990). MOREAU (1954 b) states that there were not suitable habitats for this species in Europe during the Pleistocene. The numerous finds of the Alpine Swift from Bulgaria (BOEV, 1999; in press) do not support such a point of view. The finds represent the second Pleistocene record of the Swift from Bulgaria. The species was first established in the Cave No 16 (BOEV, 1998; 1999a).

***Ptyonoprogne rupestris* (Scopoli, 1769).** A migratory and resident species of the southern parts of the Temperate zone. Inhabits the rocky terrains with vertical surfaces both in the lowland and the mountains up to 2200 m a. s. l. (HARRISON, 1982). Avoids shady and windy places. Depends on the nearness of rivers and streams. The species has a circummediterranean distribution in the Western Palearctic (CRAMP, 1989). The 20°-21,6° C July isotherms limits the breeding range (EASTHAM, 1988). The Pleistocene record of the Crag Martin in Bulgaria was established in the Bacho Kiro Cave (BOCHENSKI, 1982) and the Cave No 16 (BOEV, 1999a).

***Pyrrhocorax graculus* (Linnaeus, 1766).** A resident species of the Temperate zone, inhabiting the Alpine zone in the S-European mountains. Occurs in the steppe high-mountain terrains and rocky habitats up to the snow line (HARRISON, 1982). Strictly montane petrophylous species, usually above 1500 m a. s. l. Depends on the abundance of rock hollows and crevices for nesting (CRAMP & PERRINS, 1994). During the Wurmian it tolerated the cool climate better than *P. pyrrhocorax*. Its Quaternary sites are located in the foothills and the hilly landscapes (TYRBERG, 1991). From the Pleistocene deposits this species was published from the Bacho Kiro Cave (BOCHENSKI, 1982), the Temnata Doupka Cave (BOEV, 1994) and the Cave No 16 (BOEV, 1999a).

***Pyrrhocorax pyrrhocorax* (Linnaeus, 1758)** (Fig. 2). A resident species of the Alpine zone of the Temperate zone in Europe. Inhabits rocky habitats up to the tree line (HARRISON, 1982). Mainly occurs between 1200 and 1500 m a. s. l. A terrestrial species by its feeding (CRAMP & PERRINS, 1994). The Chough is a disappeared species in Bulgaria. The only published record come from the Late Pleistocene of the Bacho Kiro Cave (BOCHENSKI, 1982). *P. pyrrhocorax* is an indicator for the cool climate. At present 4 isolated populations survived in the

Western Palearctic. Possibly in the Wurmian they were connected each other. Many of the Pleistocene site lie out of the recent range (Tyrberg, 1991). The numerous remains of *P. pyrrhocorax* on the Balkans (Croatia) determine it as an index-fossil for the Late Pleistocene (Malez-Bacic, 1979).

***Corvus monedula* (Linnaeus, 1758).** A resident and migratory species from the Boreal to the southern parts of the Temperate zone. Depends on old trees and rock massive for the nesting. Inhabits various type of habitats (Harrison, 1982). Northwards the breeding range is limited by 12^{o} C July isotherm. The Jackdaw is an ubiquist and a terrestrial and omnivorous species by its feeding (Cramp & Perrins, 1994). Voinstvenskiy (1960) consider it as a bird of mountain origin that inhabits Europe since the Pliocene. The species was widely spread during the Pleistocene in Bulgaria. It is known from the Bacho Kiro Cave (Bochenski, 1982), the Temnata Doupka Cave (Boev, 1994) and the Cave No 16 (Boev, 1999a).

***Petronia petronia* (Linnaeus, 1766).** A resident and partly migratory species from the southern parts of the Temperate zone. Inhabits open rocky terrains of scant vegetation of grasses and scattered bushes, screes, semideserts, arid steppes. Up to 2600 m a. s. l. in the southern mountains. Do not endure the competition of *Passer hispaniolensis* (Harrison, 1982). A species of Mediterranean distribution in the Western Palearctic (Cramp & Perrins, 1994). The find of the Rock Sparrow from the Razhiskata Cave is the first Pleistocene record for Bulgaria. The site lie out of the recent breeding range. Until now, the species was known from the Pleistocene of France, Italy, Iraq, Israel, Spain and Ukraine (Tyrberg, 1998).

Conclusions

As seen, 39 taxa (27 species at least) are established in the Razhishkata Cave. One species (*Perdix palaeoperdix*) is fossil and two species (*Tetrao tetrix* and *Pyrrhocorax pyrrhocorax*) are now disappeared from the country. Nine species are established for the first time in the Pleistocene deposits of Bulgaria: *Tetrastes bonasia*, *Tringa stagnatilis*, *Athene noctua*, *Melanocorypha* sp., *Parus major*, *Fringilla montifringilla*, *Coccothraustes coccothraustes*, *Carduelis chloris* and *Petronia petronia*. Five other species are reported from their second Pleistocene site of the country: *Tetrao tetrix*, *Apus melba*, *Anthus trivialis*, *Garrulus glandarius* and *P. pyrrhocorax*. This determines the Razhishcata Cave as an important site for the Pleistocene history of the Bulgarian avifauna.

The nesting habitat preferences of the recorded species show a forest-steppe landscape in the surroundings of the cave. The correlation between the woodland and steppes (openland) species is 10:4, indicating the prevailing role of the forest habitats.

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Късноплейстоценска авифауна от Ражишката пещера, Западна България

Златозар БОЕВ

(Р е з ю м е)

От отложения от финала на късния плейстоцен са събрани 185 костни останки, принадлежащи на най-малко 55 екземпляра птици. Видовият състав включва 39 таксона (най-малко 27 вида), отнасящи се към 7 разреда. Един вид е фосилен (*Perdix palaeoperdix*), а 26 - рецентни, два от които са изчезнали от съвременната фауна на България - *Tetrao tetrix* и *Pyrrhocorax pyrrhocorax*.

За първи път в плейстоцена на България се съобщават находките на 9 вида: *Bonasa bonasia*, *Tringa stagnatilis*, *Athene noctua*, *Melanocorypha* sp., *Parus major*, *Fringilla montifringilla*, *Coccothraustes coccothraustes*, *Carduelis chloris* и *Petronia petronia*.

Ражишката пещера е второто находище в България, където са установени плейстоценски находки на други 5 вида: *Tetrao tetrix*, *Apus melba*, *Anthus trivialis*, *Garrulus glandarius* и *P. pyrrhocorax*. Това определя важното й значение за палеоавифаунистичните сведения за страната.

Според биотопичните предпочитания на видовете, в околността на пещерата е преобладавал лесостепният ландшафт. Съотношението на горски към степни (открито-ландшафтни) птици е 10:4, което е указание за доминиращата роля на горските местообитания. Петрофилните птици са представени от 7 вида, а хидрофилните - от 2.